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**"Let there be light"!! (Genesis 1.3)**

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**Resumo**

“And God saw the light, that it was good: and God divided the light from the darkness.” (Genesis 1.4). We could start this paper producing some outrageous statements; the sort of statements that in Middle Ages would call the attention and anger of Torquemada and would take us to open fire; and, as a matter of fact, some centuries latter Rudolf Carnap would probably do as much. The first would do so because of the statement itself; the latter because of its consequences. Indulge us for a while. ...

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**“LET THERE BE LIGHT”!! (GENESIS 1.3)** CRISTINA CARAMELO GOMES Prof. Dra. Arquitecta / Universidade Lusíada, Lisboa

“And the earth was without form, and void; and darkness was upon the face of the deep.” (Genesis 1.2)

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**“A**nd God saw the light, that it was good: and God divided the light from the darkness.” (Genesis 1.4)

We could start this paper producing some outrageous statements; the sort of statements that in Middle Ages would call the attention and anger of Torquemada and would take us to open fire; and, as a matter of fact, some centuries latter Rudolf Carnap would probably do as much.

The first would do so because of the statement itself; the latter because of its consequences. Indulge us for a while. The very first line of this paper, its title in fact and the weird formatting is not an accident or a misunderstanding of the rules of proper academic writing. They are part of the argument we are planning to deliver: in short, religion and science come together when it comes to light and basically light is, either way you look at it, the sacred essence of the universe.

Today's science considers the cosmological theory the best explanation for the universe. Everything started with a bang, a massive bang, the biggest ever. This bang produced energy and energy produced plasma and plasma produce matter and antimatter. All this happened in much less time than required to read these words, but, in a nutshell, a massive quantity of energy “applied” to, or emerging from, a single dot, produced all that is and all that will be. Why? What was the cause for such event? Nobel Prize winner Leon Lederman wrote in *The God Particle*: “*In the very beginning, there was a void, a curious form of vacuum, a nothingness containing no space, no time, no matter, no light, no sound.*” (Lederman, 1994)



available at: <http://www.activemind.com/Mysterious/Topics/Stonehenge/pictures.html>

Apart from the similarities between Lederman's quotation above and the first few lines of this paper, borrowed from the Holy Bible, it remains what is usually pointed as one of the major criticism to the cosmological theory and, in truth, to Einstein's relativity theory: what caused it? As Lederman said, only God knows.

What is certain is that light, understood as energy, was there. As was everything else, at least in essence. Dynamics have changed much of the rest, but the light is basically the same and thus the story of light is the history of the universe.

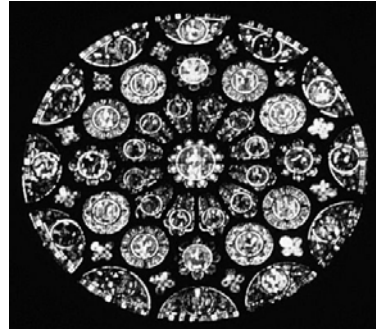
Since the beginning of the cosmos, light was the manifestation of its inner energy which transformed a dot into an inhabitable place.

Sun's formation occurred around 4 billions years ago, and the Earth was born from it. Rocks and other small particles were attracted and created a planet. Its surface cooled and hardened, carbon water and light were there and the living world appeared: amongst the earliest organisms, the autotroph, feed itself from sunlight; photosynthesis began and the Earth began its journey to house humankind (Williams, 1999)

Light influences humans biologically, affecting more than vision or coetaneous pigmentation (Mahnke, 1987), much in the same way it determined autotroph existence. But for humans it goes far beyond the physical aspect: "As far as we can discern, the sole purpose of human existence is to kindle a light in the darkness of mere being." (Jung, 1989).

## Light as an interface with God

Light is more than a physiological and survival element of human life. The Sun was synonymous of God for different civilizations, associated with the physical survival and spiritual fortitude, recognised throughout offers and initiation rituals, many of which have strong practical intentions and utilities: the amount of natural light is a consequence of the geographical location of the



available at: [http://www.bc.edu/bc\\_org/avp/cas/fnat/arch/chartres.html](http://www.bc.edu/bc_org/avp/cas/fnat/arch/chartres.html)

place and the Earth movements. This, for weather dependent civilizations, plays a vital role.

Simone Weil (1993) defines the created things as things with an intermediary character, "intermediaries" one to each other in an infinite sequence, and intermediaries in relation to God. This seems to be the intended use for many built objects from the Megalithic age, passing through the Ancient Egypt, the Middle Ages and until today.

The Grooved ware people who built Stonehenge and so many other sites in the British Isles and northern France had developed technology in those remote ages with the apparent goals of both performing astronomical observations and religious functions. Science, architecture and religion coupled in the same intention: capture the light that brings life and uncover its secrets.

Humankind has used artificial light since the discovery of fire. This glimpse of divine that humans could provoke and most of the times control gave them access to the underworld, the return to the primordial space at the mother's womb and its recreation in interior and individual space. The Lascaux caverns in France are a good example.

The ancient art encountered within these deep caves shows the use of artificial light, as they couldn't be made without it.

Matilde Pessanha wrote that the place has its own spirit, its own essence and destiny. It is a path, a bridge between worlds (Pessanha, 2003), that one can cross when accompanied with the sacred.

This idea of capturing the sacred, either with special alignments of the openings of the built object, or by the use of artificial light to travel to other worlds is a constant in humankind's history. In fact, it is a constant in architecture and this basically means that architecture is no more than the art of incorporating the sacred into a built object, by means of the scenic potential of light and shadow. One of the most interesting examples of such art is the European Cathedral builders and the stained glass techniques:

men use the divine to reveal the interpretation of the sacred that himself, printed on glass.

## **Light and the Built and Human Environment**

*"The sun never knew how great it was until it hit the side of a building."*

Louis Kahn, available at: <http://www.xs4all.nl/~irmen/thoughts/quotes/quotes.html>

Today humankind can measure the divine; light is a physical phenomenon with physical dimensions, and we know now that there is more light than the one the human eye can perceive. Human vision captures only a small part of the spectrum and interprets it with the cerebral cortex throughout a chain of physical and chemical reactions. This process produces simultaneous psychological effects. These effects may arise spontaneously or intentionally; spontaneously when the information that triggers them is human manipulation free and intentionally when that information is produced or transformed by human action.

Narboni (2003) distinguishes between nature and landscape, the first being the humanly untouched environment and the second a cultural construction and a social production. The blend of light and landscape produces intended effects and nature and light produce natural effects. In this sense, human intervention in nature takes advantage of light to create scenic effects that may be influenced by the geographical location of the site, the hour of the day, the season, and atmospheric conditions, all this intending to induce feelings and sensations.

One of the aspects that clearly influence the scenic effect in the built environment is the hour of day. In fact, built and human environment live across all the light intervals from dawn, sunrise, midday, sunset and night. This transforms a static environment into dynamic scenery; actually, as Cesare Pergola declares, it "enlivens the scenography..."

Natural light has, within the built and human environment, the responsibility of revealing the natural or artificial surrounding, external or interior area, updating our understanding towards its holistic interpretation; this phenomenon of understanding and



Salt Lake Institute, 1965 – Louis Kahn, available at: <http://www.galinsky.com/buildings/salk/>

comprehension, is the performance of the ritual way from the darkness to the light.

Louis Kahn wrote in the book of Büttiker, *Light and Space*: “*We were born of light. The reasons are felt through light. We only know the world as it is evoked by light, and from this comes the thought that material is spent light. To me, natural light is the only light, because it has mood – it provides a ground of common agreement for man – it puts us in touch with the eternal. Natural light is the only light that makes architecture.*”

Kahn has a point. Natural light makes architecture and because of that architectural conception should not neglect geographical location. Geological and atmospheric conditions can determine the number and shape of the architectonic object; the number of daylight hours within different latitudes around the planet is an irrefutable geographical condition which influence and frequently determine volumes, voids, materials, colours. Geometry, structure and materials compose the volume, and light, texture and colour compose the space. Among these, light is the most important for human experiencing. Light shapes the way of behaving towards surroundings, and the significance given to activities and/or tasks. All of us respond differently to the effects of light; experiences and cultural diversity outline our approach and preferences. At the end, structure, materials, light and human living becomes inseparable when they merge in an architectural piece.

What Kahn shouldn't have neglected is humanly produced light. Where humans should consider natural light when creating landscape, it is also truth that where natural light fails to deliver landscape the effects that humans wish, artificial light may certainly help. In the words of Lloyd Wright:

*“I referred myself constantly to a more human architecture, and I will try to explain what this means to me, as an architect: In the same way as organic architecture, the quality of humanity is inherent to man. As the solar system is calculated by ‘light-year’, the interior light can be what we usually call humanity. That element, man while light, is far beyond any calculus. Buda was named light of Asia; Jesus was named light of the world. Sun light belongs to nature, just like the interior light belongs to the human spirit:*



Fallingwater, 1955 - F. L. Wright, available at: <http://www.wponline.org/fallingwaterhome.htm>

*human light...Human imagination born, conceive and create through that interior light: died, but is still the light of existence which live in man...There is nothing more elevated within human conscience than the rays of that interior light...within human soul everything come to feed the un-extinguished light or to be feed by it. The interior light is the certainty that Architecture, Art and Religion of man are just one thing – his symbolic emblems. So, we can name the humanity as the light that ever will be extinguished."*

Pfeiffer, B.B. (1994) Frank Lloyd Wright, Taschen

Light can balance the place and the architectural object. Light, as the source of perception, has the power to improve or decrease the determination of experiencing or desertion. Light leads and permits the natural or dreamed image, perception, decision of the place. Light has more power than just illuminate; enlightens meanings, and draws the space while sets the stage towards the exhibition of everyday life. (Sottsass, 1989)

While exterior environments can always take advantage from natural light, interior environments, considering its enclosed character, enable different levels of natural light performance. Windows dimension and orientation appear as a direction towards clear and un-mysterious environments in the direction of all the imaginations that shadows can construct in human mind. A wider comprehension of the light, can classify it as an individual system, in which the artificial character flawlessly compliments and supports the natural light, maximising the chance to like our environment at all times, respecting diurnal changes and the rhythms of our lives. Although this is not an exclusive feature of interior spaces, its dimension, relative proximity between volumes and voids, textures and colour perceptions, confers them the symbolic understanding as a shelter, the extension of the human corporal body, the safe and secure territory against the possible human disturb.

Light induces biological and psychological reactions. Mahnke has shown that visible light, can influence the pineal organ, endocrine and autonomic effects, entrainment of circadian rhythms, effects on performance and fatigue, cognitive behavioural and emotional correlates. In his work "Colour, Environment and Human Response", he states that light is one of the crucial elements towards



Notre Dame de Ronchamp, 1955 – Le Corbusier, available at: [http://www.bc.edu/bc\\_org/avp/cas/fnart/Corbu2.html](http://www.bc.edu/bc_org/avp/cas/fnart/Corbu2.html)

human perception of openness in interior spaces. “Colours may evoke associations with odour and taste, appear heavy or light, give tactile impressions, be associated with sound, have volume and temperature associations...anything where color is used to inform and communicate.” (Mahnke, 1996) Based on the relationship and interdependence between colours and light is possible to extend this statement to light.

Space perception is such a more complex experiencing of place character. The use or stimulation of different human senses can enrich the perception experience as can enrich the space itself. The regular and frequent appeal towards the visual, smell, kinaesthesia and tactile attention allow the creation of different worlds as different lectures of the same space (Hall, 1966). The visual, kinaesthesia and tactile sensations are difficult to disconnect, as they are intimately related. While the first one allows the distance or difference between objects and related characteristics, the tactile one determine the distance between users and object; kinaesthesia considerations reveal the human comfort or discomfort towards available movement freedom within this space.

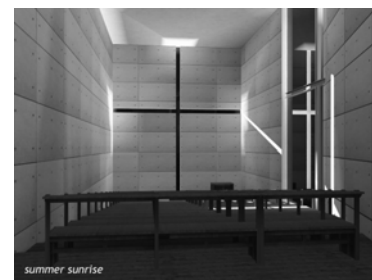
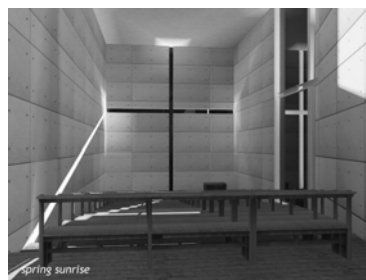
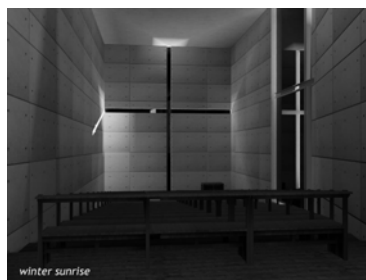
## Architectural experiences – how can the built and human environment induce different behaviours

*“Architecture is the wise, correct and magnificent play of volumes gathered under light; our eyes are made to perceive shapes under light”*, Le Corbusier, available in: <http://members.tripod.com/sevita/>

Churchill said once that the human being moulds the buildings as the buildings are going to mould the human being (Hall, 1966). Each building environment comprehends function, construction processes, and originator beginnings for form, place of implantation, natural environment, human aims, behaviours and perceptions.

Several authors as well as building examples can be found to illustrated the stated above. Among the offered possibilities, there





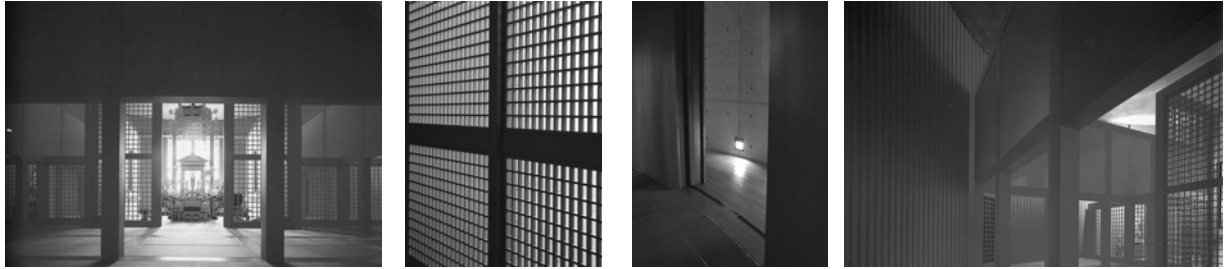
Church of Light, 1989 - Tadao Ando (3D modelling – Light Scape) available at:  
[http://architecture.mit.edu/~barandon/4.203/final\\_project\\_page.htm](http://architecture.mit.edu/~barandon/4.203/final_project_page.htm) .

was a tentative to emerge authors and works that illustrated the importance of light, and its perception as a mood and behaviour creator, as a designer of exterior environments, via the relation with the natural surrounding, and as a designer of interior environments throughout the openness or closeness offered to our senses.

As Richard Horden claims, light is the first dimension of architecture. Light exposes space, texture, colour, shadow; light informs the atmosphere and the meaning of the space. Light does more than illuminate environs; the idea of light and shadow is a cultural meaning, not just linked with the design of our landscapes, cities, buildings, but an inherent part of the life of the people for whom they are built; light may be intuitive, personal and subjective, as well as rational, measured and objective. It serves to remind us that light is an art as well as a science (Mark, 2003). The character of universal language presented by light, leads it to be used by different architects, with different backgrounds, nationalities, within different spaces in time. For them, light is the major theme independently the character, function, location, user and time of the built and human environment.

The contemporaneous awareness of the eco-urbanism, or in a holistic approach, sustainability, shows the importance of natural energy. Daylight is one of the most important natural resources and it must be considered in any architectural or landscape conception. It improves the quality of indoor environment, by the ambience created as the need of biological need of any human being to see natural daylight. Deprived of it, buildings users are not able to perceive the outside weather conditions or time of the day, deficient comfort conditions leading to strong negative physical and emotional side effects. A site analysis, climate, fenestration, reflected light and user's requirements should be carefully appraised. (Zeihner, 1996).

Spaces are now occupied 24 hours a day increasing the need for light. From the time of caverns and fires, man intercedes within natural world in an opposite manner. Nowadays he/she works, lives and plays indoor or/and artificial surroundings under his/her control – switching on the lights, temperature, noise. The most people in industrialised nations live their daily lives indoors in an artificial environment conceived and produced by man, and certainly this reality will not reverse. The need of proximity and



Temple of Water, 1991 - Tadao Ando, <http://www.andotadao.org/water1.htm>

reverence of the sacred, nevertheless, remains present and the art, as precious symbolic language, integrates this need in the built environment.

Technical advances can not neglect this evidence. Just like the message expressed within any megalithic object, medieval cathedral or modern skyscrapers, the contemporaneous built and human environment can and must be an example of the dynamic change and demand of technical advances; however, each one of the examples mentioned above has its particular way to create a message, symbol and symbolism defining a communication language liberated from any geographical or temporal constraints.

This means that landscape rather than nature is the future environment and consequently artificial light, the glimpse of divine that humankind has managed to capture, is here to stay. It allows using inner spaces, but more than that, changes night into day, creating the poetry of shadows and brightness, a unique combination of revelation and mystery that endorses the intimacy of spirituality. And, as Jung said, the 21<sup>st</sup> century will be the century of spirituality.

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